SSC COMMENTS ON: Additional ACL-related aspects of the National Standard Guidelines

June 2011 SSC minutes excerpt, starting on p 16

D-1(b) Discussion paper on groundfish uncertainty and total catch accounting

The SSC reviewed a discussion paper and received an excellent presentation by Grant Thompson (NMFS-AFSC) on several issues relating to Annual Catch Limit (ACL) measures for groundfish in the GOA and BSAI under National Standard Guideline 1 (NSG1). He identified three particular issues of concern and presented some options of how these could be addressed in the future.

1. The first issue relates to the role of uncertainty in determining groundfish ACLs. Although recent amendments to the groundfish FMPs to implement ACLs bring these plans into compliance with the revised NSGs, improvements in accounting for uncertainty in setting ACLs can be made.

The author compared two options for incorporating uncertainty: the decision-theoretic (DT) approach and the P* approach and provided an example illustrating the advantages of the DT approach in one situation. The analysis also clarifies a previous concern about the DT approach arising from the crab ACL analyses. In those analyses, the risk-averse and risk-neutral approaches resulted in very similar optimal fishing mortality rates in spite of large uncertainties. A simplified example in the discussion paper shows that under certain conditions a risk-averse manager will fish at a higher F than a risk-neutral manager to avoid bad outcomes (essentially selecting the best among the worst possible outcomes).

The SSC recommends a deliberative approach to improving the treatment of uncertainty in the groundfish FMPs and encourages the author and/or other analysts to further develop the document to (1) explore the advantages and disadvantages of the DT and P^* approaches using more realistic scenarios and (2) determine how the approaches would be applied across different tiers (Tier 1-4). This will require continued research on developing appropriate models for understanding the interactions between fisheries in response to changes in harvest policy.

2. A second issue is that the current groundfish FMPs lack a specific value for "Minimum Stock Size Threshold" (MSST) as a reference value for determining whether a stock is overfished. This is because stock assessment authors determine overfished status based on projecting current biomass forward under certain assumptions, instead of comparing it to an MSST value. Although the SSC had some concerns about adding possible confusion by reporting another reference point in addition to those that are already being computed, providing such a value would greatly simplify current reporting requirements and may provide another useful benchmark for monitoring current biomass relative to MSST. The author proposed two options for future consideration. In addition to the options provided in the document (p. 21), the SSC offers two additional options for consideration and recommends that the Plan Teams and stock assessment authors review and evaluate all options before proceeding with plan amendments.

Option 3: MSST will be set as the greater of: a) ½ B_{MSY}, or b) the smallest *equilibrium* stock size at which the stock would be expected to rebuild to B_{MSY} within 10 years if it were fished at F_{OFL} in each year.

A stock would be declared overfished if the current stock size fell below the MSST unless the current age structure would be expected to rebuild to B_{MSY} within 10 years when fished at F_{OFL}. Advantages include that the approach is fairly simple and provides a relatively stable reference point against which to measure current biomass. A disadvantage is that it might create confusion if current stock size falls below MSST, but the stock is not overfished. Moreover, it is unclear if this option is compatible with language on determining overfished status in NSG1.

Option 4: MSST will be set as the greater of: a) ½ B_{MSY}, or b) the smallest stock size at which the stock would be expected to rebuild to B_{MSY} within 10 years if it were fished at F_{OFL} in each year under the *current* age structure (proportions at age). The stock would be declared overfished if it drops below MSST. An advantage is that the approach is fairly simple and provides a reference point against which to measure current biomass. A disadvantage is that the MSST may vary considerably from year to year rather than providing a stable benchmark against which to evaluate current biomass.

3. The third issue is how to deal with removals from various sources for (A) computing various reference points and (B) counting them against harvesting specifications.

The SSC recommends that stock assessment authors and plan teams address this issue in the upcoming stock assessment cycle. Stock assessment authors should clearly lay out which sources of removals are currently included in the assessment, how removals from each source are estimated, and how they are being included in (A) and (B) above. To the extent possible, authors should discuss all known sources of mortality (including handling mortality, indirect mortality, subsistence, etc.) and which of these sources are considered in the assessment.

March 2012 SSC excerpt on D-1(b) Groundfish SEIS, p 10

5. Does the Council want to change the objectives, policy statements, or overall management approach for the groundfish fisheries?

a. The SSC notes that:

i. The AFSC will be exploring the implications of incorporating stock-specific uncertainty buffers through an ACL analysis.

June 2012 SSC excerpt on research priorities, p. 23

Refine methods to incorporate uncertainty into harvest strategies for groundfish for ACL estimation.

Continue existing management strategy evaluations at the stock level. (underway)

June 2013 SSC excerpt on research priorities, p. 22

Refine methods to incorporate uncertainty into harvest strategies for groundfish Status: Underway

Refine P* and decision theoretic methods to incorporate uncertainty into harvest strategies for groundfish for ACL estimation. Continue existing management strategy evaluations at the stock level.

JOINT GROUNDFISH PLAN TEAM COMMENTS ON: Additional ACL-related aspects of the National Standard Guidelines

August 2011, starting on p. 12

Annual Catch Limits: Grant Thompson's discussion paper described three issues related to improvements to ACL management in groundfish FMPs. Anne Hollowed provided background information on the first issue, which would expand or otherwise change the role of scientific uncertainty in determining the buffer between ABC and OFL. The implementation of ACLs for groundfish is complicated by the relationships of ACLs across stocks. A project at the University of Washington, funded by NMFS, will update a technical interactions model (developed for the groundfish PEIS) and use it to investigate implementation of decision-theoretic and P* approaches. The second issue, lack of a numeric value for MSST, did not generate much discussion but is expected to proceed with the SSC recommendations.

Under the third issue the Teams continued their discussion of the incorporation of new databases for TCA (Total Catch Accounting) and HFICE (Halibut Fishery Incidental Catch Estimates). The availability of the HFICE introduces additional sources of removals to the existing CAS (catch accounting system) estimates (including research, sportfish, etc.). *The Teams recommended that AKFIN provide a single source of removals to address potential double counting across the HFICE and CAS databases. Stock assessment authors are encouraged to include a risk analysis of potential overages of harvest specification benchmarks in their assessments to determine how the use of TCA and HFICE in particular may affect the determination of ABCs.*

The Teams recommended that the AFSC provide the following supplemental "Instructions to Authors" for the 2011 assessment cycle. The Teams recommended that all authors provide the 2001-2010 HFICE and the 2010 CAS total catch estimates as an appendix to each assessment chapter in November 2011. Since these estimates are preliminary and the Teams have not reviewed the complete database or assessed the potential effects on determination of OFL and ABC for each stock, further analysis is needed before the Teams can recommend incorporation of these estimates in their OFL/ABC recommendations. The Teams posed some issues regarding how authors should use the databases in the future: 1) how to use catch estimates with no size/age composition information in the models (similar issues occur in the Pacific halibut stock assessment), 2) how the AKRO could or would incorporate these estimates into in-season management (to avoid overharvesting) and 3) development of a single catch estimation time series incorporating all data components.

For November, several components are recommended to be included in a table in an appendix in each assessment chapter:

1) the 2010 total catch removal estimates along with research catch estimates reported in previous assessments. The major sources of removals should be noted along with any large deviations in total catch between previously used research catches and the new estimates.

2) HFICE estimates should be tabulated for the years 2001-2010 (from Cindy Tribuzio). Comparisons should be made to the corresponding CAS estimates from the AKRO.The impacts of including HFICE estimates on the total catch estimates currently used in the assessments should be discussed and the implications of these estimates on the ABC and OFL recommendations should be explored.

An agenda item will be scheduled in September 2012 to investigate the implications on ABCs. Depending on the implications and discussions that occur, the HFICE estimates may be used in stock assessments in November 2012 for the 2013 /2014 assessment cycle **but the Teams do NOT intend to use the data for determining OFLs and ABCs in November 2011 for the 2012/2013 assessment cycle.**

September 2012, starting on p. 4

ACL II discussion paper

While the Groundfish FMPs already comply with the MSA, trailing FMP amendments could augment precautionary management of groundfish stocks. Grant Thompson presented an ACL discussion paper that the SSC reviewed in June 2011 and was scheduled for GPT review in September 2011, but was rescheduled for this meeting. The paper focused on three items: 1) changing the role of scientific uncertainty in ACL and OFL, 2) lack of a numeric value for the minimum stock size threshold (MSST), and 3) which removals need to be applied in computation of reference points and which removals are counted against harvest specifications. The Teams had greater discussion of the third topic (summarized below under the report of the working group on total catch accounting), and deferred additional consideration of the first two topics until September 2013.

In Issue #1, Grant excerpted the National Standard 1 (NS1) guidelines that state that ABC is a level of a stock or stock complex's catch which accounts for scientific uncertainty in OFL and other scientific uncertainty. The guidelines basically prescribe the P* approach. The 1997 FMP amendments established the Tier 1 buffer, based on a decision-theoretic (DT) approach that accounted for uncertainty directly, while Tiers 2-6 used "fixed" buffers. This was the first use of a probability-based buffer between OFL and ABC. In 1999, FMP amendments implemented changes to comply with the MSA, in order to treat MSY as a limit rather than a target. The 2010 ACL amendments adopted the new terminology of the 2009 NS1 Guidelines. No additional action is *required* since the Groundfish FMPs have already been determined to comply with the MSA.

The current maxABC rule is based on the DT approach: risk is minimized when the stock is fished at the rate that maximizes the geometric mean of stationary yield. Under certain conditions, this fishing mortality rate turns out to be the harmonic mean of F_{MSY}. The OFL rule, however, is not the risk-neutral optimum; instead, it uses the arithmetic mean of F_{MSY}, which ensures a buffer that increases with uncertainty. Grant's discussion paper considers the alternative of setting F_{OFL} at the risk-neutral optimum. For some crab stocks, Andre Punt pointed out that sometimes with large uncertainty, the risk-averse and risk neutral optima were very close. Grant showed how this result is theoretically possible in special cases, which is disconcerting for those who believe that the buffer should always vary directly with the amount of uncertainty. However, the P* approach has problems, too; chief among which is that it does not correspond to any kind of optimization (i.e., it does not consider what is gained or lost by achieving a buffer defined by particular value of P*).

The SSC requested an economic analysis, which Mike Dalton provided in an appendix to the paper and summarized for the GPTs. This was an effort to evaluate MSY alongside maximum economic yield (MEY). In the static case, a larger biomass is obtained at MEY, because, if costs vary directly with effort, effort at MEY will be less than at MSY. This is known as the Gordon-Schaefer inequality. Jim Ianelli asked about the cost function, and what happens when it is asymptotic or when it does not start at the origin (fixed costs). Mike replied that realistic features such as rising or fixed costs do not affect the Gordon-Schaefer inequality. A weakness of the Gordon-Schaefer bioeconomic model is the restrictive assumption of scalar population dynamics based on logistic growth.

Mike presented an alternative framework that uses an age- or size-structured population dynamics model, and a "Bioeconomic Rational Expectations" model. The objective in that model is to maximize the expected net present value of the fishery subject to population dynamics. The Gordon-Schaefer inequality does not necessarily hold in this dynamic (non-static) model. Results from the bioeconomic rational expectations model are contrary to some other publications (e.g., Grafton et al. 2007), which found the Gordon-Schaefer inequality holds for some stocks with dynamic MEY. Their results were seen as a win-win for environmental and economic outcomes, and as a potential justification for ACLs. However, the bioeconomic rational expectations model makes sharp predictions about the validity of the Gordon-

Schaefer inequality at MEY. In particular, if costs are a large fraction of ex-vessel price, then the Gordon-Schaefer inequality holds (win-win). However, if costs are a small fraction of price, then constraining OFL by MSY is necessary, because market forces will otherwise cause the stock to become depleted. Therefore, expecting the win-win result to obtain in general when managing for MEY is a dubious claim, and is very situation specific.

Mike's part of the ACL presentation concluded with a static 2-stock example to demonstrate how multi-stock bioeconomic models could be used to analyze ACLs in the presence of fishery-wide constraints such as an OY cap. If the objective is to minimize total harvest costs subject to an OY cap, and per unit harvest costs are similar across species, then the cost-minimizing solution has (roughly) proportional reductions in yield below the OFL for each stock. In this case, ex-vessel prices do not affect the cost-minimizing solution. Alternatively, if the objective is to maximize ex-vessel profits subject to an OY cap, then the profit-maximizing level of effort shifts toward the higher valued species and away from the lower valued species.

Mike Sigler asked more about the linear nature of the cost curve. Linear variable cost curves were used to simplify figures in the presentation. In addition to linear variable costs, the bioeconomic rational expectations model represents three types of non-linear variable costs, including decreasing returns to scale for fixed-capacity fishing vessels, dynamic adjustment costs for changes in production levels over time, and a dynamic stock externality that affects harvest costs via search and travel. In addition, fixed costs can be included but these do not affect cost-minimizing or profit-maximizing solutions. Ed Richardson talked about how the industry generally goes through the same rationalization calculations, as evidenced by the fact that some catches are close to TAC and others are not; so results that were presented for these bioeconomic models are confirmation of what the industry is already doing.

Grant discussed the alternatives of moving forward with uncertainty changes. The P* approach complies with the NS1 guidelines but is not optimal. The DT approach does not comply with the NS1 guidelines but is more optimal. The minimum of the two approaches could be applied, which would be compliant but not always optimal (and would be more complicated than either approach individually). Mike Sigler asked how the economic analysis related to these options. Mike D. thought that the DT approach was already close and could include MEY easily. Alan said that there are a lot of cost data on crab, which could be used as an example, and that we should to look at the empirical data we have first. Jim asked whether there was much guidance on moving assessments toward being more risk neutral. Grant said that assessments and OFLs (in contrast to ACLs) are supposed to be risk-neutral, but aren't always. Alan asked what the path is, which Grant said is being discussed, but there is no specific timeline. There will be further discussion of the future path after the rest of the NS1 discussion. Anne Hollowed said that there is a post-doc working on this and any guidance on things to explore would be helpful.

Issue #2 is whether/how to determine a numeric MSST. The NS1 guidelines define MSST as either 0.5 MSY or the point at which the stock is no longer expected to rebuild to B_{MSY} in 10 years when fished at F_{OFL}, whichever is greater. The SSC concluded in 1998 that the added complexity of MSST was unnecessary in our system, so the 1998 amendments did not specify an MSST. Because the FMPs did not specify an MSST, NMFS assumed that the definition in the guidelines would apply, with the understanding that $B_{35\%}$ would be the B_{MSY} proxy for stocks managed under Tier 3. Simulation is used to determine whether a given stock is expected to be above B_{MSY} 10 years into the future when fished at F_{OFL}. The ACL amendments finally formalized this approach in the FMPs. There are at least two problems with this approach: 1) It is difficult to tell how close a stock is to being overfished and to compare performance to other U.S. fisheries; and 2) having to explain our unique system has resulted in annual struggles.

Grant conducted an analysis that showed that stocks with low natural mortality were unlikely to rebuild in 10 years, even if they started at a biomass level somewhat greater than ½ $B_{35\%}$, depending on current age structure. One option would be to use the maximum of ½ B_{MSY} or the smallest equilibrium stock size that

would be expected to rebuild to B_{MSY} in 10 years (simple, but could result in a stock being declared overfished even though it would be expected to rebuild in 10 years). Another option would be to use the maximum of ½ B_{MSY} or smallest *dis*equilibrium stock size for rebuilding (more complicated, and could result in a stock being declared *not* overfished even though it would *not* be expected to rebuild in 10 years). The SSC suggested a third option based on determining the stock size at which rebuilding would be expected to occur in 10 years if the population proportions at age were equal to those estimated in the current assessment (somewhat complicated, and the MSST would change every time the current proportions at age changed).

On a related note, from the same meeting:

National Standard 1 guidelines ANPR

This topic was for information only. Grant Thompson reported that a SSC/GPT/Council Staff work group reviewed the Advance Notice of Proposed Rulemaking on the NS1 guidelines, which was published May 3, 2012. The public comment period was subsequently extended to September 15 (and again to October 15). The Council will forward work group comments on the following 11 issues:

1. Stocks in a fishery--should clarify
2. OFL Impacts
3. ACL and OY--need additional guidance
4. Mixed stock fisheries
5. Scientific uncertainty and management -- clarification of risk
6. Data poor stocks--not all data poor stocks require federal management
7. ABC Control rules--P* should not be required
8. Total Catch Accounting (TCA)--flexibility
9. ACM -- clarify measures related to ACL
10. ACL Exceptions
11. Rebuilding progress

[See separate ANPR comment letter]

Working group reports

I. Total catch accounting

The Total Catch Accounting (TCA) Work Group report overlaps with **Issue #3 of the ACL discussion paper agenda item** and will be addressed jointly here. The 2010 ACL FMP amendments set the Council's policy for TCA for accounting for all removals by incorporating all removals as an input to the assessment models; however this has yet to be implemented in practice as the full data set is still in development. NMFS RO/AKFIN annually prepares estimates of removals for use by authors, although these do not always include all sources of removal. Currently these estimates of removals are supposed to be accounted for in an appendix table to each assessment.

The FMP states, "*To the extent practicable, each chapter contains estimates of all annual harvest specifications except TAC, all reference points needed to compute such estimates, and all information needed to make annual status determinations with respect to "overfishing" and "overfished." In providing this information, the SAFE report uses the official time series of historic catch for each stock or stock complex. This time series, which is provided by the NMFS Alaska Region, includes estimates of*

retained and discarded catch taken in the groundfish fisheries; bycatch taken in other fisheries; state commercial, recreational, and subsistence fisheries; catches taken during scientific research; and catches taken during the prosecution of exempted fisheries."

In 2011 the GPTs recommended the following:

- Authors were asked to report available "other" catch information in addition to the existing Catch Accounting System estimates as appendices to each stock assessment in the November 2011 SAFEs
- "Other" catches were to be reported only, but not used as input to stock assessment models
- Research, sport, recreational, subsistence, personal use, exempted fishing permits, etc. catches for 2010 were to be provided by AKRO as "other" removals
- Time series of Halibut Fishery Incidental Catch (HFICE) for 2001-2010 were also to be listed in the appendix
- "Other" removals were not to be used by GPTs for determining OFLs and ABCs for 2012/2013

The GPTs formed the Work Group to address how to reach full compliance for TCA requirements under the MSA. A summary of the written report of the TCA Working Group was presented by Sandra Lowe. The WG addressed several issues. One issue is a lack of consistency in the accounting of removals in the stock assessments.

- Sources for time series of catch removals (other than CAS) have not always been available, used inconsistently, and not routinely updated
- Data sets (which may cover only part of the actual time series) have been created to help account for other sources of removals including, but not limited to:
  - Research catches
  - Halibut fishery incidental catches
  - Recreational sport fishery harvests
  - Pacific cod bait catches in the crab fisheries

Remaining TCA issues:

- No associated size/age composition information (sometimes)
- Incomplete or inaccurate time series (but still best available)
- Incorporating these data for in-season management (to avoid overharvesting) is problematic
- Challenge to develop a single catch time series incorporating all data components for stock assessment use
- Advance notice of proposed rulemaking (ANPR) to potentially revise the NS 1 Guidelines (last updated 2009)

Working group recommendations:

- Authors continue to include "other" removals in appendix for 2013 but not apply those removals in the models
- "Other" removals data set continue to be compiled
- HFICE estimates not be continued
- SSC/GPT workshop to occur when NS1 guidance is provided on:
- Determination of how to use "other" removals in computation of reference fishing mortality rates and reference harvest amounts (ABC/OFL)
- How to include other catches in the "total" catch used to manage harvest specifications
- Whether to distinguish "other" removals by source such as research catches vs. fishery catches
- Development of methods for the incorporation of "other" removals for all Tier levels in the event they are used in determining reference harvest amounts

Plan Team discussion:

If possible, the GPTs would like to move in the direction of accounting for research catches differently from other removals, so that research catches would not count against the ABC. For example, perhaps research catches could be counted as a removal in the assessment but not counted against the ABC, so that they would affect the *determination* of ABC, but would not reduce TAC *from* the ABC. (As a shorthand method of approximating the likely impact of deducting research catches from the beginning biomass, an estimate of the coming year's research catches could be multiplied by the ABC exploitation rate. It may be that the impact is smaller than the rounding error typically associated with ABC recommendations. The sensitivity of this approximation could be tested by modeling the research catches as occurring at different times during the year, instead of assuming that they all occurred at the beginning of the year).

Plan Team recommendations:

- **The Teams recommend that authors continue to include other removals in an appendix for 2013. Authors may apply those removals in estimating ABC and OFL; however, if this is done, results based on the approach used in the previous assessment must also be presented.**
- **The Teams recommend that the "other" removals data set continue to be compiled, and expanded to include all sources of removal.**
- **The Teams recommend that computation of new HFICE estimates not be continued during the coming year. Once a sufficient amount of observer data are available to compare with HFICE, the time series could be filled out retroactively if comparison suggests this is appropriate. In the meantime, if individual authors want to continue the time series on their own, the code will be made available.**
- **The Teams recommend that a joint SSC/GPT workshop on TCA be held once NS1 guidance is provided. The Teams recommend that NMFS AKRO include a discussion of NEFMC and MAFMC research set-asides in its upcoming discussion paper on accounting for Scientific Research Permits/Exempted Fishing Permit removals (scheduled for review in December 2012).**